2.0 TECHNOLOGY APPLICATIONS ANALYSIS

This section assesses the general applicability of GFT to remediate PCB- and metal-contaminated sediment from Superfund and other hazardous waste sites. This assessment is based on results from the demonstration of the technology under the EPA SITE Program.

2.1 FEASIBILITY STUDY EVALUATION CRITERIA

This subsection assesses the GFT relative to the nine evaluation criteria used to conduct detailed analyses of remedial alternatives in Feasibility Studies (FSs) performed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This assessment of FS criteria assumes that the contaminated sediment will be transported to a fixed treatment facility and delivered in a dewatered state. Applicable or relevant and appropriate requirements (ARARs) regarding transportation, dewatering, and handling of pre-treatment waste are not considered to be part of this evaluation.

2.1.1 Overall Protection of Human Health and the Environment

This section addresses whether a technology provides adequate protection and describes how risks posed by each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Minergy claims that the GFT provides both short- and long-term protection to human health and the environment by binding hazardous inorganic constituents into a noncrystalline, glass-like product. A risk evaluation to assess potential impact to human health and the environment was not performed as part of the SITE process.

In a full-scale operation, potential accidental releases during treatment could temporarily affect air quality in the vicinity of the treatment facility. Short-term exposure to workers may also occur during various materials-handling tasks.

2.1.2 Compliance with Applicable or Relevant and Appropriate Requirements

This criterion addresses whether a remedy will meet all of the ARARs of federal and state environmental statutes. General and specific ARARs identified for the GFT are presented in Section 2.2. Compliance with chemical-, location-, and action-specific ARARs should be determined on a site-specific basis. Compliance with chemical-specific ARARs depends on the chemical constituents of the waste and the Treatment Efficiency (TE) of the glass melter system.

2.1.3 Short-term Effectiveness

Short-term effectiveness addresses the period of time needed to achieve protection of human health and the environment, as well as any adverse impacts that may be posed during the treatment period until clean-up goals are achieved.

Melting is a proven treatment technology for hazardous wastes contaminated with PCBs and inorganic constituents. Sediment melting transforms the physical state of contaminated sediment from assorted granular matrices to a glassy solid state. The Minergy process transforms sediment into a glass aggregate with minimal PCB and organic contaminants, and inorganic contaminants are incorporated into the glass matrix making them resistant to leaching. Exposure to contaminants during treatment should be minimal because of the design of the full-scale GFT, which includes automated handling and dust collection.

2.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

The anticipated performance of this treatment technology's potential for use at a Superfund site was assessed with respect to its ability to reduce the toxicity, mobility, or volume of waste. The GFT reduces the toxicity of the dredged-and-dewatered sediment by destroying organic contaminants and incorporating hazardous, inorganic constituents into a glass matrix, resistant to leaching. Test data from the Minergy SITE demonstration indicated that mercury and PCB concentrations in dredged sediment could be reduced to below laboratory detection in the final aggregate product. An almost three-fold volume reduction of sediment to glass aggregate was observed during the SITE demonstration.

2.1.5 Long-term Effectiveness

Long-term effectiveness refers to the ability of a technology to maintain reliable protection of human health and the environment over time. Based on Synthetic Precipitate Leaching Procedure (SPLP) and American Society of Testing and Materials (ASTM) water leach analyses performed on glass aggregate during the technology demonstration, it appears that any PCBs and metals present in the aggregate are resistant to leaching by aqueous solvents, rendering them biologically unavailable. Water leaching tests simulate natural weathering and can indicate whether the material will be resistant to leaching contaminants to groundwater.

PCBs and other organic contaminants present in the sediment are treated in the furnace atmosphere. In the GFT, metals are incorporated into the glass structure, thereby rendering metals resistant to leaching, based on the results of the leaching-test analyses. Crushed aggregate subjected to leaching analysis also indicated no contaminants will leach from the glass material over time.

2.1.6 Implementability

To consider the technical and administrative feasibility of a technology, including the availability of materials and services needed to implement a particular option, implementability of the technology is considered. GFT previously has been used to treat sludge from paper mills, power plants, and municipal wastewater processors. Only minor modifications to the handling systems and air pollution control system are required to use a similar system for treatment of PCB-contaminated sediments.

2.1.7 Costs

Estimated capital and operation and maintenance costs, as well as net present worth costs were considered for the SITE evaluation. For large-scale projects the GFT appears to be a cost-effective treatment alternative to landfilling. Section 3.0 of the report provides a detailed discussion of cost for this application.

2.1.8 State Acceptance

This criterion addresses technical or administrative issues and concerns that the support agency may have regarding the technology. This SITE demonstration project was performed cooperatively among EPA-ORD, WDNR, and EPA-GLNPO.

2.1.9 Community Acceptance

The SITE evaluation needs to address any issues or concerns the public may have regarding the GFT. Public acceptance of this technology should be positive for two reasons: (1) the technology presents minimal short- or long-term risks to the community, and (2) the material is permanently treated and not just relocated from one area (contaminated site) to another (landfill).

Contaminated sediment is a relatively common problem throughout the United States, with sediment removal and landfilling or solvent extraction generally being the most preferred remediation methods. The public is currently reluctant to accept placing PCB- and mercury-contaminated sediment in landfills. The public also has expressed a desire to explore remediation technologies that address the contaminant exposure pathway. The GFT can help in addressing the problem of disposal of contaminated dredge materials. Providing acceptable and cost-effective disposal of contaminated sediment would resolve the public’s concern with contaminated sediment disposal and could significantly enhance clean-up actions.

2.2 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE GLASS FURNACE TECHNOLOGY

This subsection discusses federal and state environmental regulations that could be pertinent to operation of the GFT, including transport, treatment, storage, and disposal (TSD) of wastes and treatment residuals during a response action pursuant to CERCLA, as amended by the SARA. CERCLA provides for federal funding to respond to releases or potential releases of any hazardous substance into the environment, as well as to releases of pollutants or contaminants that may present an imminent or significant danger to public health and welfare or to the environment.

SARA includes a strong statutory preference for innovative technologies that provide long-term protection and directs EPA to:

- Use remedial alternatives that permanently and significantly reduce the volume, toxicity, or mobility of hazardous substances, pollutants, or contaminants.

- Select remedial actions that protect human health and the environment, are cost-effective, and involve permanent solutions and alternative treatment or resource recovery technologies to the maximum extent possible.

- Avoid off-site transport and disposal of untreated hazardous substances or contaminated materials when practicable treatment technologies exist.

In general, two types of response actions are possible under CERCLA: removal activities and remedial actions. The GFT would be part of a CERCLA remedial action.

Remedial actions are governed by SARA amendments to CERCLA. As stated above, these amendments promote remedies that permanently reduce the volume, toxicity, and mobility of hazardous substances, pollutants, or contaminants. The GFT is a toxicity reduction technology because it reduces PCBs and other contaminant concentrations in solid media.

On-site CERCLA remedial actions must comply with federal and more stringent state ARARs. CERCLA provides no ARARs itself; instead, CERCLA requires that remedial actions comply with substantive requirements of other environmental statutes. ARARs are determined on a site-by-site basis, considering the types of chemicals present (chemical-specific), actions taken and waste streams generated (action-specific), and location of the site in relation to sensitive environments (location-specific). Location-specific ARARs depend on site-specific conditions and are not addressed in this report.

This discussion addresses potential chemical- and action-specific ARARs. The GFT is designed to treat chemicals such as PCBs, metals, polynuclear aromatic hydrocarbons, VOCs, and metals. Waste streams generated by GFT relate to the material to be treated, dryer condensate, the desired properties of treated material, and personal protective equipment (PPE). The GFT is an *ex-situ* treatment technology, and generation and disposal of PCB waste, when exceeding 50 ppm, is regulated by TSCA and its implementing regulations at 40 CFR Part 761. If other contaminants also are present at a site, site wastes should be characterized to determine whether they meet the definition of hazardous wastes under RCRA. If so, RCRA requirements for management of hazardous wastes also will be ARARs for this technology.

Specific ARARs that may be applicable to the GFT are identified in Table 2-1.

2.2.1 Resource Conservation and Recovery Act

RCRA, an amendment to the Solid Waste Disposal Act, is the primary federal legislation governing hazardous waste activities. RCRA was enacted in 1976 to address safe disposal of the enormous volume of municipal and industrial solid waste generated annually. Subtitle C of RCRA contains requirements for generation and TSD of hazardous waste, most of which also are relevant and appropriate to CERCLA activities where hazardous wastes are managed. The Hazardous and Solid Waste Amendments of 1984 greatly expanded the scope and requirements of RCRA.

These regulations are applicable to the GFT only if RCRA-defined hazardous wastes are treated or generated during the CERCLA action. Regulations that are likely to be listed as ARARs include the requirement to characterize waste for a hazardous waste generator (40 CFR Part 262.11), the requirement to determine if the hazardous waste is restricted from land disposal (40 CFR Part 268.7(a)), and either 40 CFR Part 262.34(a) for storage of waste on site up to 90 days prior to off-site shipment or 40 CFR Part 264.553 for storage of waste in a temporary unit for up to 1 year prior to disposal. Requirements for treatment and disposal units are considered to be ARARs for this process, because waste storage will be conducted on site. Waste generated by the GFT included treated material, dryer condensate, and used PPE. These materials would require analysis to determine requirements for disposal or discharge. If these wastes are determined to be hazardous according to RCRA (either because of a characteristic or a listing carried by the waste), all substantive RCRA requirements regarding management and disposal of hazardous waste must be addressed by remedial managers. Criteria for identifying characteristic hazardous wastes are included in Title 40 Code of Federal Regulations (CFR) Part 261, Subpart C. Listed wastes from specific and nonspecific industrial sources, off-specification products, spill clean-ups, and other industrial sources are itemized in 40 CFR Part 261, Subpart D. The technology could be used on sites where lead, cadmium, chromium, mercury, or other metals are present and could, depending on concentrations, be characteristic hazardous wastes. PPE and clean-up wastes from a PCB-contaminated site (if greater than 50 ppm) may not be disposed of in an ordinary landfill. It must be disposed of in a TSCA chemical waste landfill or a TSCA incinerator. Because this is a fixed treatment facility that will have waste delivered to the site, clean-up waste should not be an issue. PPE used at the treatment facility will require special disposal.

Listed hazardous wastes (40 CFR Part 261, Subpart D) remain listed wastes, regardless of the treatment they may undergo and final contamination levels in the resulting effluent streams and residues. This regulation implies that, even after remediation, treated wastes are still classified as hazardous if the pre-treatment material was a listed waste. Under the contained-in policy, listed wastes contained in other materials that are managed as waste require that those materials be managed as listed wastes. Material can be de-listed in many cases, depending on the attributes of the treated material.

For generation of any hazardous waste, the responsible party must obtain an EPA identification number. Other applicable RCRA requirements may include a Uniform Hazardous Waste Manifest (if the waste is transported), restrictions on placing the waste in land disposal units, time limits on accumulating waste, and permits for storing the waste.

RCRA corrective action regulations regarding corrective action management units (CAMUs) and temporary units may be ARARs for CERCLA action involving RCRA hazardous waste. The CAMU rule allows for disposal of remediation wastes without triggering land disposal restrictions and minimum technology requirements. The temporary units rule allows treatment or tanks without triggering RCRA tank regulations.

2.2.2 Toxic Substances Control Act

TSCA grants EPA authority to prohibit or control the manufacture, import, processing, use, and disposal of any chemical substance that presents an unreasonable risk of injury to human health or the environment. Regulations promulgated under TSCA may be found at 40 CFR Part 761.

Most of the PCB contamination addressed by this technology will be in waste that contains more than 50 ppm PCB contamination and is defined as "PCB remediation waste" under 40 CFR Part 761.3, and its remediation and disposal will be regulated by 40 CFR Part 761.61. Three options in 761.61 to dispose of PCB remediation waste, and substantive clean-up levels are provided in 761.61(a), the "self-implementing" clean-up option. Requirements in Part 761.61(b) are for a "performance-based" option for disposing of PCB remediation waste and give performance specifications for certain disposal technologies such as incineration and placement in a chemical landfill. The final option is for a "risk-based approval" and is found in 40 CFR Part 761.61(c). This option contains no substantive requirements or ARARs, but allows EPA Regional Directors to approve remedial actions for PCBs through a site-specific, risk-based decision.

Minergy's GFT demonstration was considered to be exempt from TSCA because PCB concentrations in the sediment were consistently below 50 ppm. The full-scale implementation will likely treat sediment with PCB concentrations greater than 50 ppm, and approval for treatment of that sediment would be subject to EPA approval.

2.2.3 Clean Air Act

The CAA and its 1990 amendments establish primary and secondary ambient air quality standards for protection of public health and emission limitations on certain hazardous air pollutants.
CAA permitting requirements are administered by each state as part of State Implementation Plans developed to bring each state into compliance with National Ambient Air Quality Standards (NAAQS). Ambient air quality standards for specific pollutants apply to the operation of the GFT system, because the technology ultimately results in an emission from a point source to ambient air. Allowable emission limits for the operation of a GFT system will be established in a case-by-case basis, depending on the type of waste treated and whether the site is in a NAAQS attainment area. Allowable emissions limits may be set for specific hazardous air pollutants, particulate matter, hydrogen chloride, or other pollutants. An air pollution control system will likely be required to control the discharge of emissions to the ambient air.

2.2.4 Occupational Safety and Health Administration

Several requirements must be addressed, although they are not ARARs. CERCLA remedial actions and RCRA corrective actions must be performed in accordance with the Occupational Safety and Health Administration (OSHA) requirements detailed in 29 CFR Parts 1900 through 1926, particularly 29 CFR Part 1910.120, which provides for the health and safety of workers at hazardous waste sites. On-site construction activities at Superfund or RCRA corrective action sites must be conducted in accordance with 29 CFR Part 1926, which describes safety and health regulations for construction sites. State OSHA requirements, which may be significantly stricter than federal standards, also must be met. All technicians operating the GFT system are required to have completed an OSHA training course and must be familiar with all OSHA requirements relevant to hazardous waste sites. Noise levels are an OSHA concern, but GFT noise levels are not expected to be high. Therefore, anticipated noise levels are not expected to adversely affect the community.

2.2.5 Department of Transportation Regulations

Once dredged sediment is dewatered, it may need to be transported, depending on the siting of the treatment facility. Minergy's intent is to site the treatment facility as close to dredging-and-dewatering operations as possible. Off-site shipment of hazardous materials is subject to Department of Transportation (DOT) requirements for packaging and placarding. Additionally, if the treated material was generated from a RCRA-defined hazardous waste, the material would be subject to DOT regulations in 49 CFR Parts 172 and 173.

2.2.6 Comprehensive Environmental Response, Compensation, and Liability Act Off-Site Rule

The CERCLA Off-site Rule requires that wastes taken from a CERCLA site for off-site disposal must be transported to permitted waste disposal facilities. Each EPA Region has a coordinator for assistance in identifying disposal facilities in the region that are in compliance with their appropriate permits and that are approved to receive waste from CERCLA sites.

CERCLA covers specific environmental regulations pertinent to demonstration and operation of the GFT, including transport and treatment, storage, and disposal of wastes and treatment residuals. CERCLA, as amended by SARA, requires consideration of ARARs. CERCLA issues, although not true ARARs, also are considered.

2.3 OPERABILITY OF THE TECHNOLOGY

A schematic of the GFT process is shown as Figure 1-1. According to Minergy, the first step in the glass aggregate recycling process is to receive dewatered sediment at the full-scale treatment facility. It is assumed that sediment will be dewatered in the vicinity of dredging operations, unless a pipeline is used to transfer sediment slurry to the treatment facility. Within the treatment facility, the sediment will be conveyed to a drying system, where the solids are dried to approximately 10 percent moisture. The dryer will be vented to the melter furnace to ensure that contaminants potentially released in dust during the drying process are treated.

The GFT is designed so that dried sediment will be conveyed from the dryer system to the melter, at which point sediment melts and flows out of the furnace as molten glass. High temperatures in the furnace are expected to remove or destroy organic compounds contained in the sediment, including PCBs. In addition, the melting process is expected to permanently stabilize the metals within the glass.

The molten glass flows into a water quench bath, where it cools quickly and forms the glass aggregate product. In this form, the glass aggregate product can be stored and handled similarly to conventional quarried aggregates. Some crushing and screening can be done, as required to meet the size requirements of a particular application. Potential markets for the glass aggregate product include floor tiles, abrasives, roofing shingles, asphalt and chip seal aggregates, and decorative landscaping.

2.4 KEY FEATURES OF GLASS FURNACE TECHNOLOGY

This section describes the key features of the GFT process, which may separate it from other remedial technologies. These features may be unique to the Minergy GFT.

2.4.1 Contaminant Reduction

One of the primary objectives of the SITE evaluation was to assess the efficiency of the GFT in removing or destroying PCB concentrations in the sediment. This objective was accomplished by sampling the sediment before treatment, the glass aggregate, the furnace flue gas, the quench water, and the cooling tower discharge water. The PCB concentration in the dewatered sediment averaged 28.8 ppm based on a geometric mean. The geometric mean of the PCB concentrations in the glass aggregate was 1.4×10^{-4} ppm.

The treatment efficiency (TE) was calculated using the geometric mean of the total PCB concentrations from each sampled media. The TE calculation is further discussed in Section 4.3.3.1.

2.4.2 Mass Reduction

The SITE demonstration began in June 2001, but the melter run was interrupted because of a failure of the furnace refractory brick, allowing molten glass to leak. About 4,900 kg (11,000 lbs) of river sediment had been processed at the time the system shut down. After the furnace was repaired, the demonstration was restarted in August 2001, during which steady operating conditions were achieved and maintained throughout the demonstration. About 7,500 kg (17,000 lbs) of sediment were processed during the August demonstration.

A total of 12,400 kg (27,000 lbs) of sediment was treated during the two demonstrations, resulting in the generation of about 4,900 kg (11,000 lbs) of glass aggregate. A mass reduction of 2.5 to 1 was observed during the demonstrations, based on information obtained from Minergy.

2.4.3 Glass Aggregate Qualities

Minergy claims that the glass aggregate product has qualities that support its value in the marketplace. It does not leach PCBs or metals and has desired physical properties, such as high particle density. These properties qualify the product for use as construction fill, floor-tile component, roofing-shingle granules, or an additive to concrete.

2.4.4 Full-scale Design

Minergy has designed a full-scale GFT system to support large river-sediment dredging operations. The treatment facility is expected to be located nearby dredging and dewatering operations to minimize transportation costs. The design incorporates mixing and drying, flux addition and mixing, and melting. The design incorporates several distinctive elements, such as, heat exchangers to capture lost heat and run the dryers, venting to reduce particulates in the air stream, and closed conveyors to move sediment without creating dust. The full-scale GFT is designed to melt 600 tons per day of dewatered sediment and produce 250 tons per day of glass aggregate. A unit cost study was performed by Minergy that evaluated costs to build and run full-scale treatment facilities of 250, 500, and 750 tons of glass per day.

2.4.5 Clean Air Emissions

Glass furnaces use oxygen-fuel burners, combining natural gas and oxygen to heat the furnace. The burners raise the internal temperature of the furnace to 1,600 °C (2,900 °F). The use of oxygen instead of atmospheric air keeps nitrogen oxide emissions low and results in a cleaner burning operation. PCB emissions from the pilot-scale melter were low (geometric mean of the samples collected was 3.5×10^{-6} ppm).

2.4.6 Costs

Unit costs for the full-scale implementation of Minergy's GFT are detailed in Section 3.0. The cost to treat dewatered sediment with the GFT was estimated at $38.74 per ton. These costs are comparable to landfilling costs. Because it appears that contaminant concentrations in the treated glass aggregate have been permanently removed, or are resistant to leaching, the future liability associated with landfilling the glass product seems to be much lower than that associated with landfilling the dewatered sediment.

The glass produced by the GFT may have some economic value that could offset some of the implementation or disposal costs. Additionally, reuse of the treated material will minimize the need to landfill the glass aggregate, reducing the need for landfill space.

2.5 APPLICABLE WASTES

The GFT process produces a glass aggregate product from contaminated sediment. There are three sources of process wastewater: quench-tank water, condensate from the dryer exhaust, and blowdown from the exhaust cooling tower. The condensate from the dryer exhaust and blowdown from the exhaust cooling tower will likely require permitting and treatment prior to disposal.

2.6 AVAILABILITY AND TRANSPORTABILITY OF EQUIPMENT

The GFT process for handling contaminated soils was initially developed by Minergy to process wastewater sludge into glass aggregate that could be sold as a commercial product. The melter is modified from a standard glass furnace. Other components, such as the indirect heat disc or paddle dryers and packed cooling towers, are used in other industries and can be modified to fit the requirements of the GFT process. Based on the amount of on-site assembly required, facility construction would be expected to take about 9 to 12 months. Minergy states that, for a project of suitable size, design work could begin immediately. The size of the equipment limits the potential for a transportable unit. Because the equipment is housed within a building, the facility could be constructed anywhere that space and permitting would allow.

2.7 MATERIALS-HANDLING REQUIREMENTS

The GFT process is most efficient when feed materials contain less than 10 percent water and metal particles, such as nuts or bolts, etc., have been minimized. Mixing is necessary to get the material to feed through the dryers, where the moisture content will be reduced to about 10 percent. Waste feed may require the addition of a fluxing agent to control melting temperatures and improve the physical properties of the glass aggregate product. For the SITE demonstration, waste feed pretreatment consisted of reducing the particle size, removing excess metal, drying, and blending with 5 percent sodium sulfate by weight. Large pieces of material, iron in particular, are expected to be found in the dredged sediment. These pieces will be removed before pumping the sediment slurry or mixing the dewatered sediment with dried sediment. After processing through the full-scale GFT, the glass aggregate product will be withdrawn from the water quench by a set of screws, dewatered, and transported to a storage pile. The aggregate will then be removed from the site for sale or disposal.

2.8 LIMITATIONS OF THE TECHNOLOGY

The GFT system has several limitations. Since the treatment facility is not transportable, material must be delivered to the facility for treatment. The material must be dewatered, either mechanically or passively, to about 50 percent moisture prior to drying. Additional indoor storage of feed material will be required in cold climates to keep material in a non-frozen state.

Although the cost analyses performed in this ITER are based on a project that would treat 1-million-tons of sediment, Minergy claims that melters could be scaled to accomodate sediment projects of most sizes. This could include sediment from multiple sites that can be delivered to a centrally-located treatment facility.

TABLE 2-1
POTENTIAL FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE GLASS FURNACE TECHNOLOGY

Process Activity	ARAR	Description	Basis	Requirements
Sediment Characterization	RCRA 40 CFR Part 267 or state equivalent	Identify and characterize sediment to be treated.	A RCRA requirement must be met before managing and handling waste.	Chemical and physical analyses must be performed.
Notification	TSCA 40 CFR Part 761	Mandate notification to EPA of PCB waste activity.	Any activity associated with PCB waste has notification requirements.	Notify EPA with Form 7710-53.
Transportation for Off-site Treatment	RCRA 40 CFR Part 262 or state equivalent	Mandate manifest requirements, packaging, and labeling prior to transporting.	Waste may require manifesting and managing as a hazardous waste.	An ID number must be obtained from the EPA.
	RCRA 40 CFR Part 261 or state equivalent	Set transportation standards.	Waste may need permits for transportation as a hazardous waste.	A licensed hazardous waste transporter must be used.
Storage of Sediment Prior to Processing	RCRA 40 CFR Part 264 or state equivalent	Apply standards for storage of hazardous waste.	The sediment will be stored on site prior to treatment.	If separate storage building is not used, material must be placed on and covered with plastic to minimize fugitive air emissions volatilization and water infiltration.
	TSCA - 40 CFR Part 761	Apply standards for storage of PCB waste.	The sediment will be stored on site prior to treatment.	Storage is limited to 1 year, unless written notification is granted from EPA. The storage facility must be constructed to control runon/runoff and must be approved by EPA.
Waste Processing - Smelting, Melting, and Refining Furnace	RCRA 40 CFR Parts 264, 265, 266 (Boilers and Industrial Furnaces Rule in Subpart H and Part 270)	Apply standards for the melting of hazardous waste at permitted and interim status facilities.	Processing of hazardous waste must be conducted in a manner that meets RCRA operating and monitoring requirements.	Equipment must be maintained daily. Air emissions must be characterized by continuous emissions monitoring. Equipment decontamination is required upon completion.

TABLE 2-1 (continued)
POTENTIAL FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE GLASS FURNACE TECHNOLOGY

Process Activity	ARAR	Description	Basis	Requirements
Storage After Processing	RCRA 40 CFR Part 264 or state equivalent	Apply standards for the storage of hazardous waste.	If vitrified product is derived from treatment of a RCRA-listed waste, requirements for storage of hazardous waste in containers will apply.	The vitrified product must be stored in containers that are well-maintained and stored in an area constructed to control runoff.
Disposal	RCRA 40 CFR Part 264 or state equivalent	Apply standards for landfilling hazardous waste.	By-products derived from treatment of hazardous waste may need to be managed as hazardous waste.	Wastes must be disposed of at a RCRA-permitted facility, or EPA approval for other disposal action must be obtained.
Disposal	RCRA 40 CFR Part 268 or state equivalent	Apply standards that restrict placement of certain hazardous wastes on the ground.	The waste may be subject to federal Landfill Disposal Regulations (LDRs)..	Waste must be characterized to determine if LDRs apply; treated waste must be tested and results compared to the standard.
	TSCA 40 CFR Part 761 or state equivalent	Apply disposal options for PCB remediation waste.	PCB waste is subject to federal requirements regarding disposal.	Apply in writing to the EPA regional administrator for risk-based disposal approval.
Post-treatment Transportation	RCRA 40 CFR Part 262 or state equivalent	Apply manifest requirements and packaging and labeling requirements prior to transporting.	By-products may need to be manifested and managed as hazardous waste if they are derived from hazardous waste.	An ID number must be obtained from EPA.
	RCRA 40 CFR Part 263 or state equivalent	Apply transportation standards.	By-products may need to be transported as a hazardous waste if they are derived from hazardous waste.	An EPA licensed transporter must be used.
Flue Gas Emissions	CAA or equivalent State Implementation Plan	Control air emissions that may impact air quality standards.	An off-gas treatment system is part of the glass furnace technology system design.	Treatment of contaminated air must adequately remove contaminants so that air quality is not impacted.

TABLE 2-1 (continued)
POTENTIAL FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE GLASS FURNACE TECHNOLOGY

Process Activity	ARAR	Description	Basis	Requirements
Worker Safety	OSHA 29 CFR Parts 1900 through 1926; or state OSHA requirements	Apply worker health and safety standards.	Comprehensive Environmental Response, Compensation, and Liability Act remedial actions and RCRA corrective actions must follow requirements for the health and safety of on-site workers.	Workers must have completed and maintained OSHA training and medical monitoring; use of appropriate personal protective equipment is required.

Notes: ARAR - Applicable or relevant and appropriate requirements
CAA - Clean Air Act
CFR - Code of Federal Regulations
EPA - U.S. Environmental Protection Agency
ID - identification
LDR - landfill disposal restrictions
OSHA - Occupational Safety and Health Administration
PCB - Polychlorinated biphenyl
RCRA - Resource Conservation and Recovery Act
TSCA - Toxic Substance Control Act